INSECT RESISTANCE OF COMPOSITE CANS

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ABSTRACT

Cans variously made of kraft, aluminum foil, polymer films, and glassine were not penetrated by boring and invading insects during 29 months' storage in an infested room. Such cans would protect foods against insect contamination during shipment and storage.

INTRODUCTION

A food processor can prevent insect contamination of his products at the plant, but he has little control over conditions elsewhere. Packaged foods may be exposed to insect infestations in railcars, trucks, or ships, during storage in central or outlying warehouses, and in retail outlets. Insect-resistant packages are therefore important, especially in today's world of food shortages, rising costs to consumers, increasingly stringent sanitation regulations (both here and abroad), and consumer rejection of infested foods.

Laboratory storage tests were conducted to determine the insect resistance of spiral-wound cans made of various combinations of heavy kraft paper, aluminum foil, polymer films, and glassine paper. Known as composite cans, they are already used to package motor oil, frozen citrus concentrate, and snack foods.

MATERIALS AND METHODS

Forty-eight cans of each construction described in table 1 were prepared by the manufacturer (Sonoco Products Company, Hartsville, S.C.).[2] The cans were standard 404 × 509 size (1-qt) with metal ends, and each contained 0.5 lb of insect-free white wheat flour. All cans were placed in corrugated shipping cases, each holding 12 cans. The bottom flaps

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[2] Company names are used solely to provide specific information. Such mention does not constitute a guarantee or warranty of products by the U.S. Department of Agriculture or an endorsement by the Department over others not mentioned.

were glued; the top flaps were left unglued so that the cans could be removed for inspection.

TABLE 1.—*Construction and seals of composite cans evaluated for insect resistance*[1]

Code	Interior	Inner liner seal
	FOIL EXTERIOR	
1A	Glassine	Sealing strip.
2A	PE (0.67-mil)	Fold.
3A	PP (1-mill)/ foil/adhesive/ kraft (25-lb).	Do.
4A	Foil/adhesive/ kraft (25-lb).	Sealing strip.
6A	Foil/PE (10-lb) on reverse side.	Overlap and heat seal.
7A	Foil/PE (1-mil)/kraft (25-lb).	Sealing strip.
8A	PP (1-mil)/foil/ PE (7-lb)/kraft (25-lb).	Fold.
	PAPER EXTERIOR	
1B	Glassine	Sealing strip.
2B	PE (0.67-mil)	Fold.
3B	PP (1-mil)/foil/ adhesive/kraft (25-lb).	Do.
4B	Foil/adhesive/ kraft (25-lb).	Sealing strip.
6B	Foil/PE (10-lb) on reverse side.	Overlap and heat seal.
7B	Foil/PE (1-mil)/kraft (25-lb).	Sealing strip.
8B	PP (1-mil)/foil/ PE (7-lb)/kraft (25-lb).	Fold.

[1] All cans have metal ends double-seamed to the wall with sealing compound; the wall is 2-ply paperboard liner weighing 69 lb/1,000 ft^2. All foil was 0.00035-inch except the exterior foil of 6A and 6B, which was 0.001 inch. PE, polyethylene; PP, polypropylene.

The cans were transported immediately to Savannah for extended exposure to large populations of both boring and invading insects in a simulated warehouse. The cases were turned upside down so that the unglued flaps were held closed by the weight of the cans. All cases were randomized in four blocks, each block containing one case of each type.

All cans were examined monthly for 21 months. To make sure that there was sufficient insect pressure on the cans, insects in the cases were counted during each of the first three monthly examinations. After the cans had been examined for insect damage, they were replaced in the cases, and the cases were returned to their original positions in the experimental blocks. After 14 months' storage, about 50 adult *Trogoderma variabile* Ballion (an important boring insect) were placed in each case to provide greater insect pressure on the cans. To further increase insect pressure, the cans were removed from the cases after 21 months' storage and placed directly on pallets on the floor for another 8 months. The cans were again examined monthly for insect penetrations.

In an abbreviated test one-half pound of dry, sterilized dogfood was placed in eight each of can numbers 2A, 2B, 1B, and 6A. Ten *T. variabile* larvae were placed in each can just prior to sealing. These cans were held in an uninfested area at 80° F for 14 months and examined each month for insect penetrations. After 14 months the cans were opened and examined for live insects.

RESULTS AND DISCUSSION

Although many insects were found in the cases during the first three monthly examinations (table 2), no insect penetrated any can during 21 months of storage in the cases. Also, no cans were penetrated during 8 months of direct exposure to insects on the pallets.

During 14 months of storage, *T. variabile* larvae penetrated 1 of the 32 cans in which they had been sealed. This penetration appeared at 7 months in a can constructed with a paper exterior and glassine liner (code 1B). None of the 32 cans contained live insects after 14 months.

In these tests composite cans provided excellent protection from insect infestations. These cans would be especially useful for protecting relatively expensive foods such as spices, health foods, and "natural" cereals; the cost of such cans reportedly falls between the price of all-metal cans and flexible film pouches.

TABLE 2.—*Insects found inside cases of composite cans during 3 months' exposure to stored-product insects*

Block No.	Average number of insects in cases after[1]—					
	1 month		2 months		3 months	
	LGB	FB	LGB	FB	LGB	FB
1	60.0	7.6	43.7	11.4	14.4	10.1
2	61.5	6.6	24.2	9.8	27.6	13.5
3	56.6	6.8	31.0	8.3	21.1	12.4
4	57.1	4.9	30.3	7.2	24.3	7.8

[1] LGB, lesser grain borer, *Rhyzopertha dominica* (F.); FB, flour beetles, *Tribolium castaneum* (Herbst) and *T. confusum* Jacquelin du-Val. Also occasionally found were rice weevils, *Sitophilus oryzae* (L.); cigarette beetles, *Lasioderma serricorne* (F.); flat grain beetles, *Cryptolestes pusillus* (Schoenherr); sawtoothed grain beetles, *Oryzaephilus surinamensis* (L.); and *Trogoderma* species.